

E 100 105 110 115 120 125 130 135 140 145 150 155 E

N 40

TYPHOON NAT
BEST TRACK TC-22W
15 SEP- 02 OCT 91
MAX SFC WIND 110KT
MINIMUM SLP 933MB

DTG SPEED INTENSITY

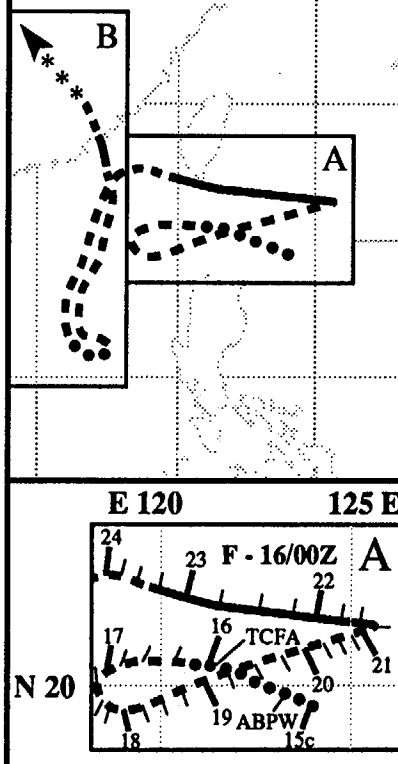
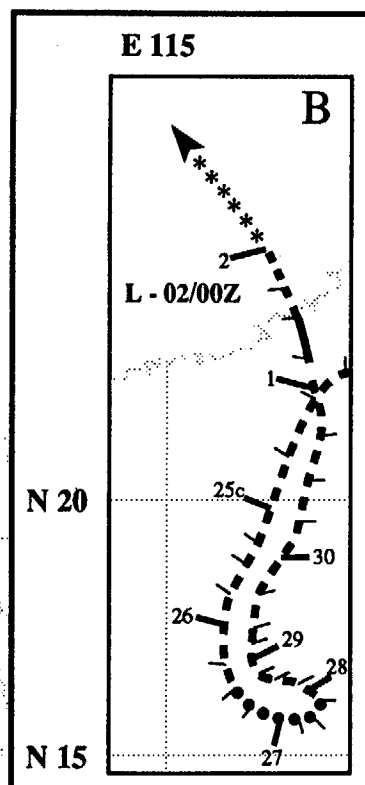
16/00Z	7	30
16/06Z	8	35
16/12Z	7	35
16/18Z	6	40
17/00Z	4	40
17/06Z	4	40
17/12Z	3	35
17/18Z	3	35
18/00Z	4	35
18/06Z	5	40
18/12Z	5	40
18/18Z	5	40
19/00Z	6	40
19/06Z	6	35
19/12Z	7	35
19/18Z	7	35
20/00Z	6	40
20/06Z	5	45
20/12Z	4	50
20/18Z	3	55
21/00Z	3	60
21/06Z	3	70
21/12Z	4	85
21/18Z	5	95
22/00Z	6	105
22/06Z	6	110
22/12Z	8	110
22/18Z	9	105
23/00Z	9	105
23/06Z	7	90
23/12Z	6	70
23/18Z	4	60
24/00Z	4	55
24/06Z	5	50
24/12Z	7	45
24/18Z	12	45
25/00Z	10	45
25/06Z	7	45
25/12Z	4	40
25/18Z	7	40
26/00Z	6	35
26/06Z	8	35

LEGEND

\ / \ 6-HR BEST TRACK POSITION
 a SPEED OF MOVEMENT (KT)
 b INTENSITY (KT)
 c POSITION AT XX/0000Z
 ○ ○ ○ ○ ○ TROPICAL DISTURBANCE
 ● ● ● ● ● TROPICAL DEPRESSION
 - - - - - TROPICAL STORM
 ————— TYPHOON
 ◆ SUPER TYPHOON START
 ◇ SUPER TYPHOON END
 ✦ ✦ ✦ EXTRATROPICAL
 ✦ ✦ ✦ SUBTROPICAL
 *** DISSIPATING STAGE
 F FIRST WARNING ISSUED
 L LAST WARNING ISSUED

DTG SPEED INTENSITY

26/12Z	5	30
26/18Z	4	30
27/00Z	6	30
27/06Z	3	30
27/12Z	2	30
27/18Z	3	30
28/00Z	3	35
28/06Z	2	40
28/12Z	4	40
28/18Z	3	45
29/00Z	3	50
29/06Z	3	55
29/12Z	3	55
29/18Z	7	55
30/00Z	8	55
30/06Z	8	60
30/12Z	8	60
30/18Z	9	60
01/00Z	8	60
01/06Z	7	65
01/12Z	8	65
01/18Z	7	50
02/00Z	8	35



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TYPHOON NAT (22W)

I. HIGHLIGHTS

Typhoon Nat's motion was highly erratic and included four major track changes, two intensification episodes, and two landfalls in 17 days. It persisted longer than any other tropical cyclone that formed in the western North Pacific during 1991, requiring a total of 61 warnings which was only 18 warnings shy of the record set by Typhoon Rita (1972). Its track and behavior was reminiscent of Typhoon Wayne (1986).

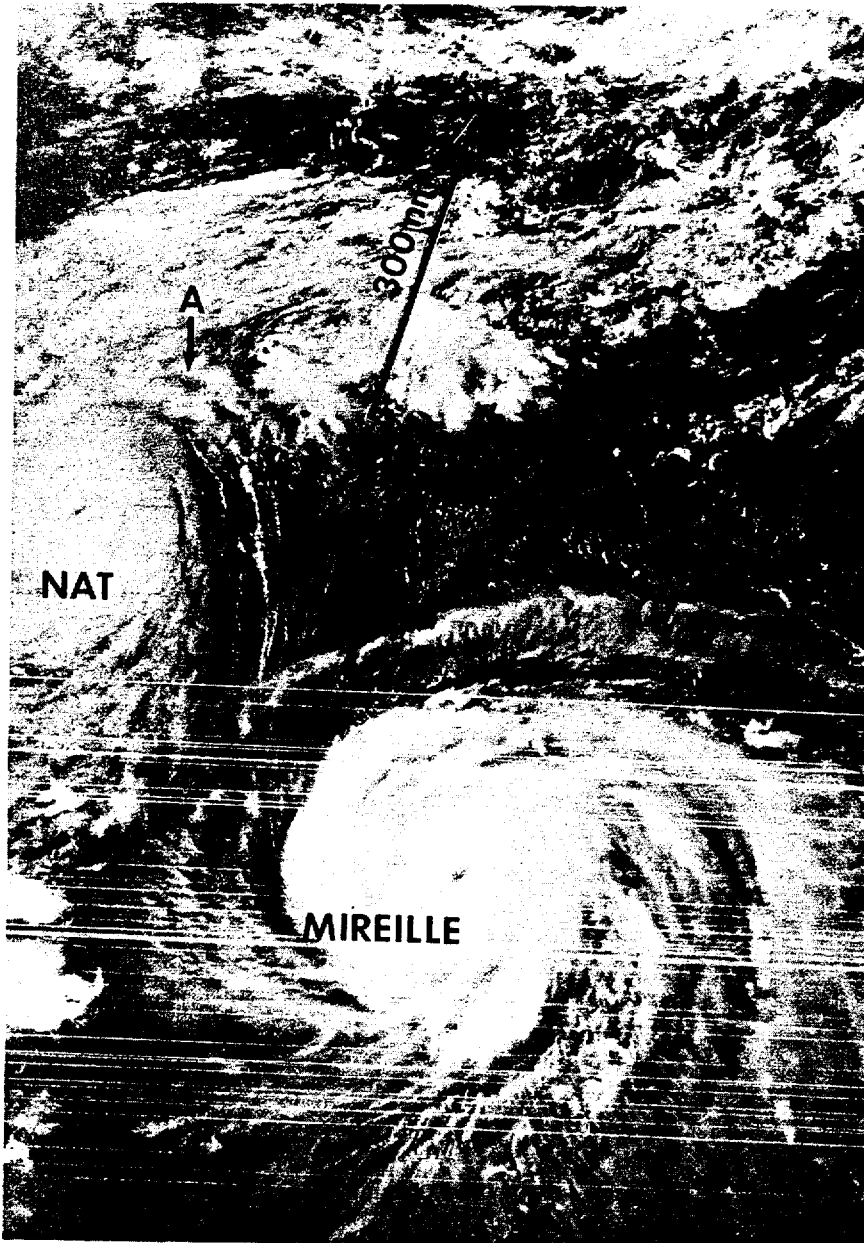


Figure 3-22-1. Moonlight imagery reveals the eyes of Typhoons Nat and Mireille (21W). Lightning flashes can be seen east of Taiwan near point A (221059Z September DMSP visual imagery).

II. TRACK AND INTENSITY

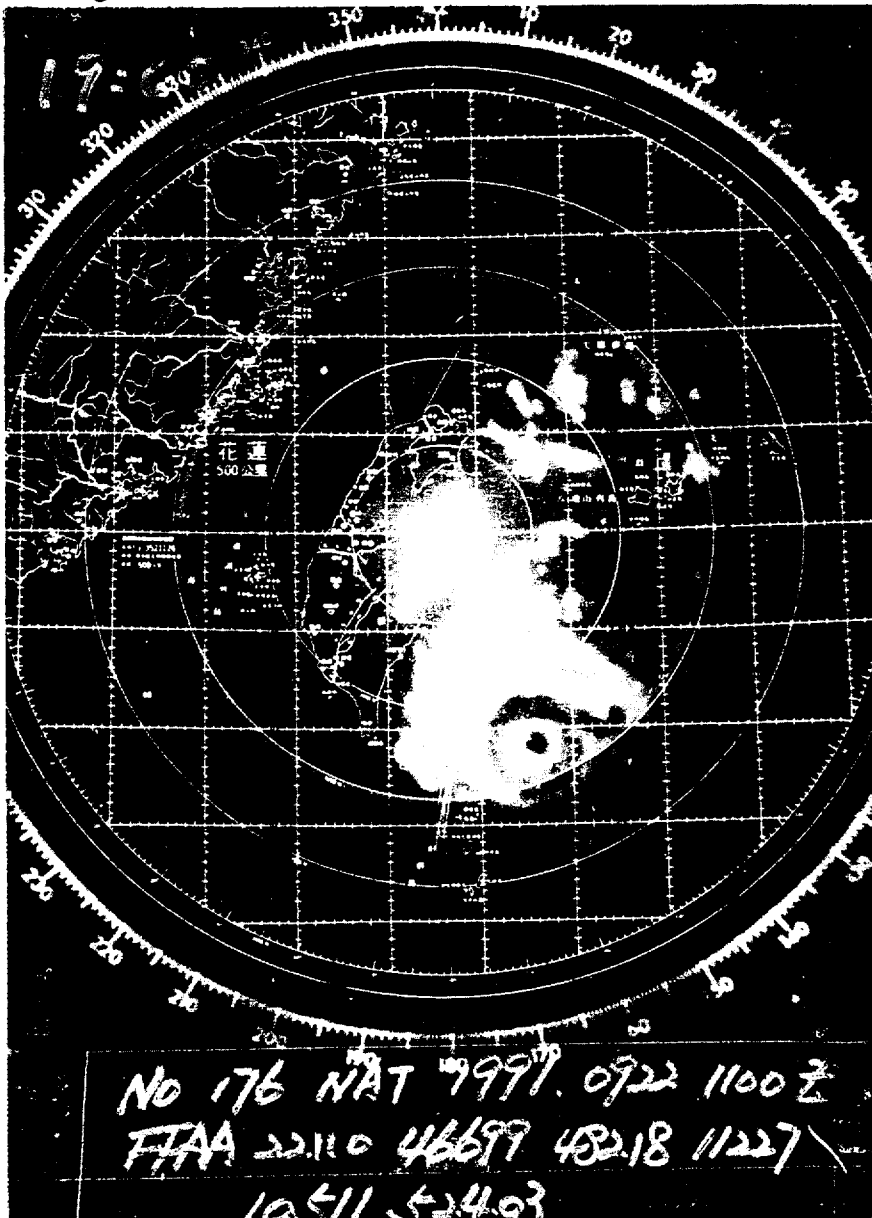
Nat's convection developed in the monsoon trough just east of the Luzon Strait and was first mentioned on the 150600Z Significant Tropical Weather Advisory. At 152300Z, improved cloud organization prompted a Tropical Cyclone Formation Alert. The alert was followed only an hour later by the first warning based on a 27 kt (14 m/sec) synoptic report and an estimated minimum sea-level pressure of 1003 mb. Nat initially intensified very slowly due to its proximity to land and to strong upper-level winds outflowing from Tropical Storm Luke (20W) which was located to the east. The influence of these two factors lessened after a surge in the southwest monsoon carried Nat to the east through the Luzon Strait, and Luke recurved. From 21 through 22 September, Nat underwent rapid deepening to almost super typhoon intensity. After Luke's departure, the ridge re-established itself and Nat (Figure 3-22-1 and 3-22-2) reversed direction to enter the Luzon Strait again. Nat made landfall (Figure 3-22-3) on the southern tip of Taiwan and rapidly weakened. Contributing factors to

the weakening were the proximity of the high mountains of Taiwan and the approach of Typhoon Mireille (21W) from the southeast with its outflow causing increased upper-level wind shear. During the binary interaction with Mireille (See Figure 3-21-2 in Mireille's write-up), Nat was downgraded to a tropical depression before the larger system, Mireille, escaped northeastward. Nat reintensified to typhoon intensity before making landfall, then dissipated over the rugged terrain of southeastern China. The final warning was issued at 020600Z.

III. FORECAST PERFORMANCE

Because the passage of two tropical cyclones to the east eroded the subtropical ridge, the steering flow in which Nat was embedded was weak. Track forecasting proved to be a real challenge,

but forecast errors were respectable considering the erratic nature of the tropical cyclone. From the suite of objective aids, FBAM and CSUM seemed to provide the best overall performance. They both simulated the loop to the south caused by the surge into Tropical Storm Luke (20W); however, they were less successful in forecasting the binary interaction with Super Typhoon Mireille (21W). OTCM and NOGAPS had a very difficult time with this system. As an example, Figure 3-22-4 shows the forecast guidance for the 230000Z warning while Nat was over southern Taiwan.



IV. IMPACT

Even though Nat was small in size and no reports were received, the typhoon's crossing of extreme southern Taiwan and, later, the southern coast of China must have disrupted communications and transportation and caused some localized damage.

Figure 3-22-2. The radar at Haulien (WMO 46699), Taiwan paints Nat's concentric rainbands (221300Z September photo courtesy of the Central Weather Bureau, Taipei, Taiwan).

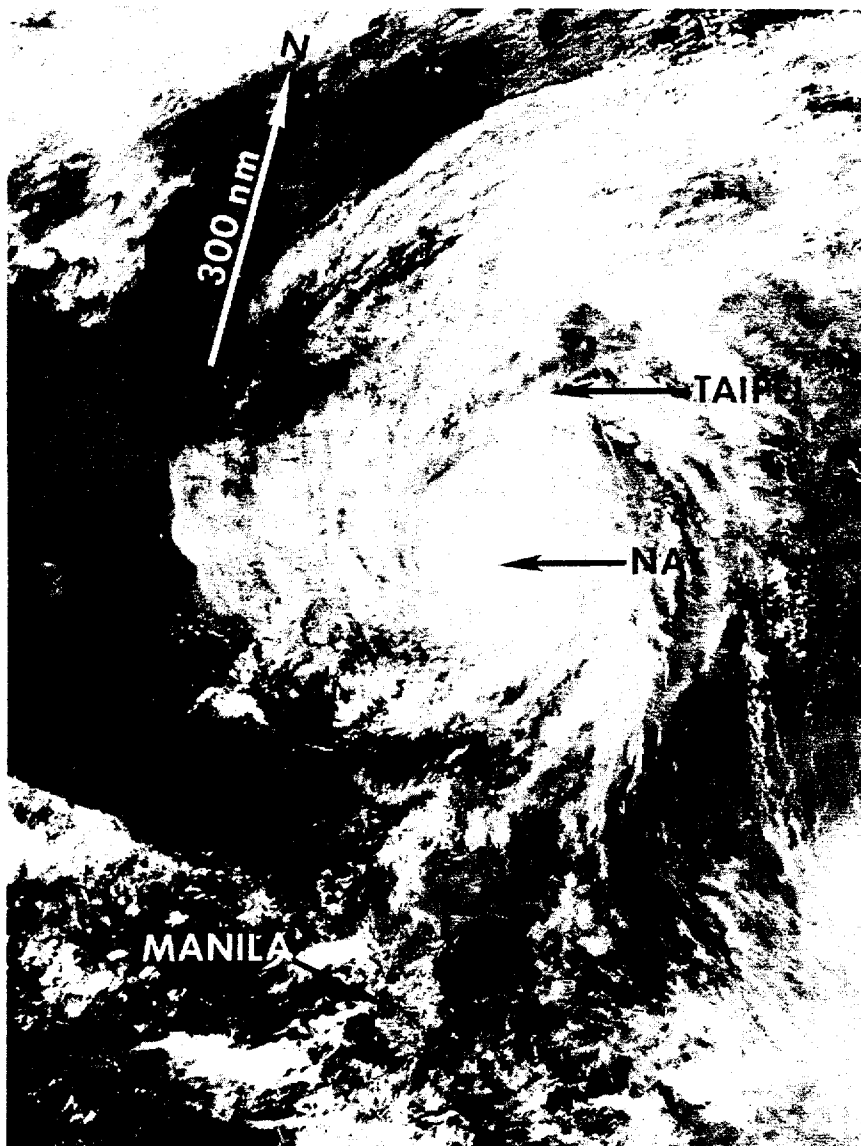


Figure 3-22-3. Nat crosses southern Taiwan (230110Z September DMSP visual imagery).

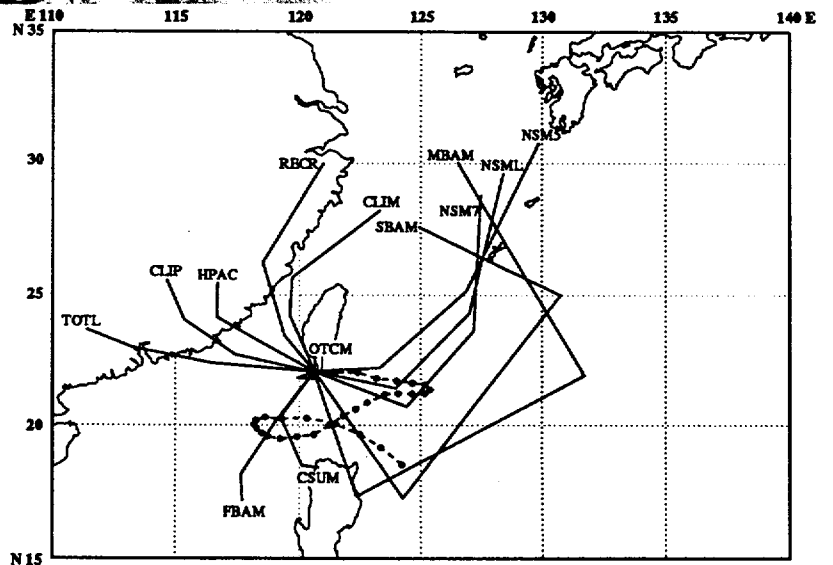


Figure 3-22-4. Forecast guidance supporting the 230000Z September warning for Typhoon Nat.